THELEPHORA TERRESTRIS, T. FIMBRIATA, AND T. CARYOPHYLLEA ON FOREST TREE SEEDLINGS

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WITH PLATE V.

During the field seasons of 1912–1916 a number of specimens of the genus Thelephora were sent to the writer by field and nursery men of the several National Forests in the Northwest with inquiry as to their pathological significance. The specimens were usually accompanied by some such statement as "growing around the base of young trees," "growing around and over seedlings," or "on roots of trees." Two of the species sent have not previously been reported as causing injury to forest tree seedlings.

THELEPHORA TERRESTRIS (EHRH.) FR.

Robert Hartig (4, 5) reported *Thelephora terrestris* Ehrh. (*T. laciniata* Pers.) as sometimes occurring so abundantly in silver fir, spruce and Weymouth pine plantations that young plants were frequently completely enveloped. This strangling process continued until the tip of the seedling barely projected above the surface of the fungus, resulting in death. In like manner, Hartig reports the smothering of beech seedlings when growing close together. The destruction of spruce seedlings or the branches of older trees which may lie on the ground, by *Thelephora terrestris*, is mentioned by Frank (2, p. 235). The Weymouth pine, firs and red beech were seldom affected. Tubeuf (9, 10) gives brief accounts of the injury to young fir trees and of one-year-old beech seedlings by *Thelephora terrestris*.

An anonymous account (8) of the injurious effects of this fungus on various seedlings, in England, shows that it may extend up the stem for a distance of a foot or more.

Mention of the injury sometimes resulting from the growth of *Thelephora terrestris* around tree seedlings is made by Lindberg (6).

Freeman (3) refers to the fungus in relation to forest tree seedlings, but does not think much damage may result from it in Minnesota. Later references may be found in text-books on plant diseases by Sorauer, Stevens, and others.

It will be seen from the foregoing that *Thelephora terrestris* is the only member of the genus so far reported as injurious to forest tree seedlings. Schrenk (7) has described a root rot of apple trees caused by *Thelephora galactina* Fr. (Nov. Symb. Myc., pp. 136) but this fungus is now classed by Burt in Corticium. Schrenk states that the rot caused

by this organism was transferred from oak roots to young apple trees, killing the latter within a year.

The states and localities in which *Thelephora terrestris* has been observed to injure forest tree seedlings are recorded as follows:

British Columbia: encrusting the stems of *Acer macrophyllum*, Salmon Arm: *Pseudotsuga taxifolia* seedling partially enveloped, Agassiz.

Washington: on two-year *Pseudotsuga taxifolia* seedling near Olympia; completely enfolding the stem and needles of two-year seedlings of *Pinus monticola*, Metaline Falls, matting the leaves of a clump of two-year seedlings of *Thuja plicata*, Newport.

Oregon: growing around the base of young seedlings of *Pinus ponderosa*, Austin.

Idaho: growing around the stem and partially enveloping the needles of *Abies grandis*, Priest River; around stems of young *Pseudotsuga taxifolia*, *Pinus ponderosa* and *Picea engelmani* on nursery area at Priest River Experiment Station.

Montana: enveloping the base of an eight-year-old *Larix occidentalis*, not connected with the forest soil, Pattee Canyon, Missoula; (Fig. A) partially enveloping a young seedling of *Pinus contorta*, Anaconda, and on various pine seedlings at the Forest Service Nursery, Haugan.

Utah: growing around stem of young *Pinus ponderosa*, locality not given (Forest Service).

Wyoming: enveloping seedlings of *Pinus contorta*, Encampment.

South Dakota: attached to stem and roots of young *Acer negundo*, Camp Crook.

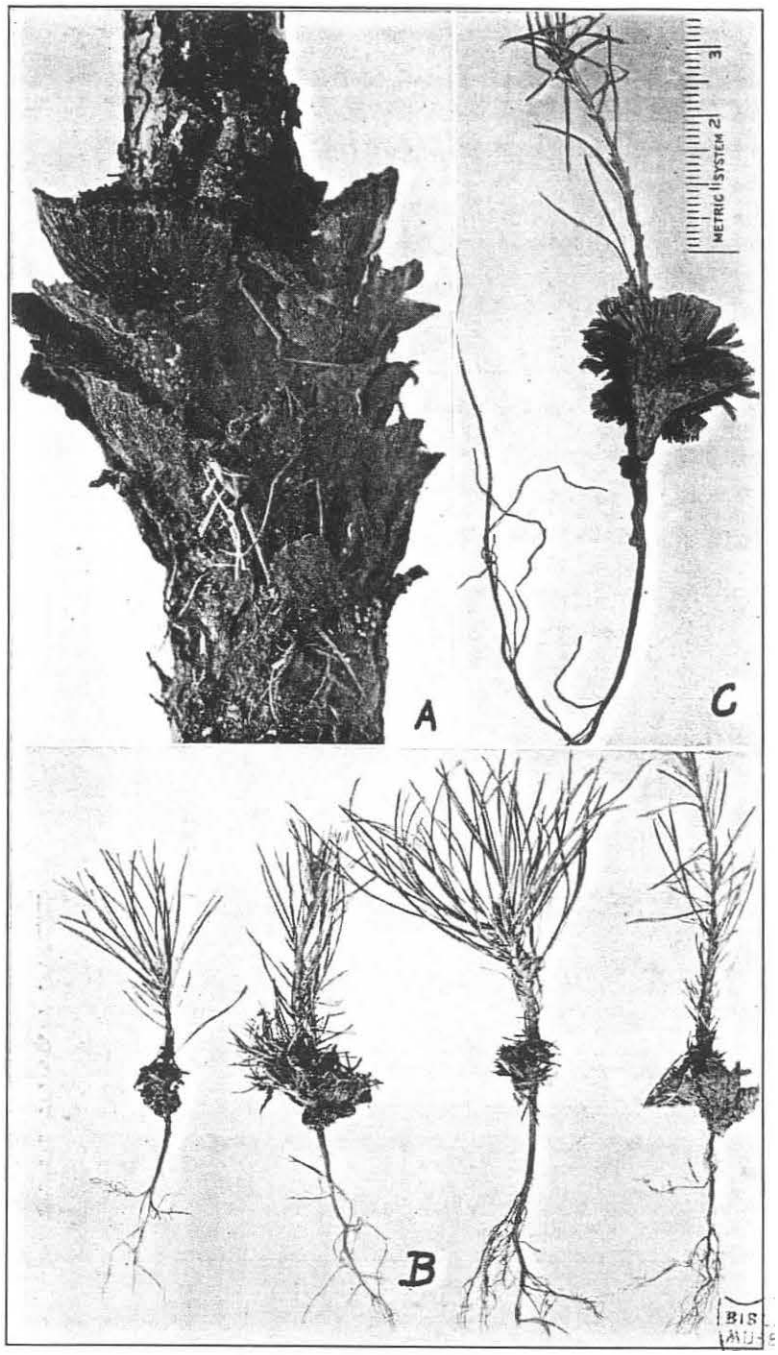
Minnesota: enveloping the needles of *Picea mariana*, Ely.

Michigan: growing at base and attached to the epidermis of seedlings, *Pinus divaricata*, East Tawas.

Indiana: surrounding the stem of two-year-old *Quercus alba*, Weirtown.

Various plants other than forest tree seedlings are overrun and killed by this fungus. An interesting case of the destruction of a seedling of *Ribes prostratum* is shown by a collection made by Dr. A. S. Rhoads, at North Conway, New Hampshire. *Thelephora intybacea* (Pers.) Fries, which resembles *T. terrestris*, is observed to strangle various plants, but has not been recorded on forest tree seedlings.

The fact that *Thelephora terrestris* may envelop a young seedling much more rapidly and more permanently than a number of the fleshy and coriaceous Polypores, is the chief reason why attention is given it, and especially because the fungus frequently appears in the sandy soil of forest tree nurseries. The fungus usually occurs where the seedlings are dense enough to shade the ground. Although the behavior of the fungus is often apparently parasitic, repeated examination of the



THELEPHORA SPP. SMOTHERING CONIFER SEEDLINGS.

young pine seedlings enveloped by it has not shown any living part to be invaded. The mycelium ramifies in the surface soil and merely penetrates the dead outer tissues of any plant encountered. If the plant is completely smothered by the fungus, its mycelium may penetrate into the tissues of the leaves through the stomata and even form a brown layer between the dead bark and wood of the stem. The fungus is very often found hibernating in the thick moist bark at the base of young trees, in which case the mycelia may not be connected with the forest soil (Fig. A). The fungus may draw its nourishment entirely from a moist woody substratum. Burt (1, p. 219, 220) points out the interesting fact that the substratum from which the fungus draws its nourishment exercises an influence on the form and color of the fructification.

When not attached to any woody material the fruiting body is a dark fuscous color and consists of a flattened cluster of small imbricated pileoli, or is composed of a series of super-imposed pileoli. On wood the fructification is of a redder color and reflexed. The habit of growing on both humus and decaying wood is exhibited by a number of the higher fungi which the writer has known to smother seedlings by growing around them. Among them may be mentioned *Polyporus tomentosus*, *Polyporus perennis*, and *Clavaria stricta*.

During damp weather the fungus grows very rapidly and may envelop a small seedling in a comparatively short time. A one-year-old seedling of *Thuja plicata* 5 cm. high, having at its base a young fungus, was completely enveloped in 7 days. A rule set up by the side of the seedling showed that the fungus grew more rapidly during the night, registering in one instance an extension in height of 6 mm. in one night.

Seedlings in nurseries affected with *Thelephora terrestris* should be pulled up and burned. It was found that when this was done at the Savanac Nursery the fungus did not develop in the beds the following year. The use of duff or forest soil in the seed beds promotes the growth of the fungus.

THELEPHORA FIMBRIATA SCHW.

In the seed beds of the Forest Service nursery at Haugan, Montana, during July, 1914, and again in 1915, *Thelephora fimbriata* appeared in considerable quantity. Two- and three-year-old seedlings of *Pinus ponderosa* were in some cases completely enveloped. The usual type of injury was the complete envelopment of the stem and matting of the lower needles (Fig. B). The late E. C. Rogers reported to the writer that in 1915, at the Haugan Nursery, he found 18 yellow pine seedlings in one bed affected by this fungus.

Seedlings of *Pinus rigida* partially overgrown with *Thelephora fimbriata* were received from H. H. Morgan, of the Pennsylvania Department of Forestry in 1916. The seedlings were from the State Nursery on the Black Forest in Lycoming County. The fungus was reported common.

THELEPHORA CARYOPHYLLEA (SCHAEFFER) FR.

This fungus was observed growing up around one-year-old seedlings of *Larix occidentalis* (Fig. C) and *Tsuga heterophylla* in seed beds at the Priest River Experiment Station, Idaho, in 1915. Since then it has not reappeared, but is abundant in the surrounding forest, where it is occasionally found enveloping the stems of young lodgepole pine seedlings. This species is one of the most beautiful of the genus and is frequently very abundant in damp coniferous woods.

SUMMARY

An account of the occurrence of *Thelephora terrestris* on coniferous seedlings in nurseries and on other plants is given. The injury of coniferous seedlings by *Thelephora fimbriata* and *T. caryophyllea* is reported for the first time.

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